JOURNAL OF INFORMATION POLICY 4 (2014): 250-269.

MAKING INFORMATION TECHNOLOGIES WORK AT THE END OF THE ROAD

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Remote and rural areas face many challenges, including the provision of telecommunications services. Regardless of universal service policies or other political promises, rural communities can be deemed unprofitable by service providers while government assistance is managed by faraway regulators who lack understanding of the affected communities and citizens. The authors assess these challenges in the context of the First Nations of Canada, via a decentralized "First Mile" framework. They find that these remote communities are capable of local innovation and can collaborate with intermediary organizations to build digital infrastructures, by bridging the gap between the public and private sectors.

INTRODUCTION

One of the guiding theoretical constructs of the Internet is that it enables and empowers the edges of technical, economic, political, and social networks. To a considerable degree this initial (in part utopian) vision has been derailed, as the Internet's role as an agent for the centralization and concentration of power and resources has become more visible. Critical political economists argue that the Internet is now sustaining the dominant position of commercial and governmental institutions in society.[1] While the social web to a degree lateralizes horizontal communication, the technical drivers for these developments have the effect of reinforcing those centralizing tendencies.

In recent years, Internet governance has become increasingly oriented towards market forces as the primary means to supply answers to the problems faced by consumers of broadband and other

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The authors extend a special note of appreciation to Fort Severn First Nation for allowing us to conduct this research in collaboration with them. The Fort Severn study that is the basis for this article was conducted as part of the First Nations Innovation (FNI) project. The FNI partners – the First Nations Education Council, Atlantic Canada's First Nation Help Desk, Keewaytinook Okimakanak, and the University of New Brunswick – contributed in-kind resources to the project. The Social Sciences and Humanities Research Council has supported this team with six research and outreach grants since 2004.

[1] Robert W. McChesney, *Digital Disconnect: How Capitalism Is Turning the Internet Against Democracy* (New York: The New Press, 2013).

services. But at the same time, governments intervene heavily in the broadband marketplace.[2] For example, they provide significant public funds to corporate interests that claim to have no business case to develop services and infrastructure for users in remote and rural regions.[3] This contradiction between the rhetoric of leaving development to market forces alongside heavy government intervention in cases of market failure is built into the legal and regulatory frameworks (or absence thereof) governing Internet/broadband deployment.[4] The result is that in such cases, the direct provision of public subsidies to corporate telecommunications companies leaves little recourse for community action. With exceptions, governments tend to directly transfer public funds to corporate interests that subsequently make decisions about broadband networks and Internet services according to their prerogatives. We suggest that these choices leave out consideration of the specific needs expressed by communities, which amplifies the centralizing tendencies described above.

The increasingly widespread availability of broadband infrastructure and services threatens to reinforce and accelerate these trends.[5] From a Community Informatics perspective, the options of user communities may become limited to those deemed acceptable within the framework of existing corporate and organizational structures.[6] For example, in highly networked urban centers where connectivity is relatively cheap and ubiquitous, the market for networks and applications enables a variety of options. In such areas, the availability of consumer choice is sufficient to satisfy most user demands. Where a demand is not satisfied, a large enough aggregate of customers can articulate their interests, and in most cases a commercial supplier will provide the desired service.

This market logic is expressed in the ways that broadband infrastructures are used to provide public services. Traditionally, the provision of services like education, health care, and policing/security is understood as largely under the control and direction of authorities located in urban environments – governments, school boards, hospital managers, and so on – that choose among competing delivery options available in the marketplace. However, a different dynamic plays out in rural and remote regions where the infrastructures to support public service delivery systems are costly, slow to build, and difficult to replace. Funders perceive that these systems are onerous to change and adapt to local contexts and as a result, centralized institutions control the broadband infrastructures and applications that deliver public services to remote and rural communities. But is this the only development path available to people living "at the end of the road?"

Researchers are starting to identify community-based development patterns that offer alternative ways to look at broadband deployment, including for public and community service delivery. For example,

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[2] Robert E. Babe, *Telecommunications in Canada: Technology, Industry and Government* (Toronto: University of Toronto Press, 1990).

[3] Duncan Philpot, Brian Beaton, and Tim Whiteduck, "First Mile Challenges to Last Mile Rhetoric: Exploring the Discourse between Remote and Rural First Nations and the Telecom Industry," *Journal of Community Informatics* 10 (2014), accessed May 12, 2014, http://ci-journal.net/index.php/ciej/article/view/992/1080.

[4] Marita Moll and Leslie R. Shade, "From Information Highways to Digital Economies: Canadian Policy and the Public Interest," paper prepared at the World Social Science Forum, Montreal, Oct. 13-15, 2013.

[5] See for example Manuel Castells, *Communication Power* (Oxford, UK: Oxford University Press, 2009); Tim Wu, *The Master Switch: The Rise and Fall of Information Empires* (New York: Alfred A. Knopf, 2010).

[6] Michael Gurstein, *What is Community Informatics (and Why Does It Matter?)* (Milan, Italy: Polimetrica, 2007).

Dorothea Kleine applies Amartya Sen's "capabilities" approach to human development in an examination of ICT policies in rural Chile.[7] She concludes that this framework might help connect people in rural communities with the decisions of far-off policymakers and practitioners. Inside North America, Susan Crawford writes of the potential of municipal and community networks to open new possibilities for local involvement in broadband development and service provision.[8] Krishna Jayakar suggests that with the proper policy supports in place, community-based and non-profit "middle-mile" institutions can act as mediators between service providers and communities of interest. These organizations also generate positive externalities by supporting broadband adoption, economic development, and educational opportunities, including for unserved and marginalized populations.[9]

In this article we consider an approach from Canada, where Indigenous communities with defined powers of self-government have established new possibilities for broadband services adapted to local requirements.[10] First Nation peoples remain closely tied to the place-based communities that ground their customary laws, institutions and practices.[11] Inside their communities, many remote and rural First Nations struggle with economic, environmental and resource issues. Many residents lack clean drinking water, adequate housing and employment opportunities. Poverty is rampant, especially in small, remote First Nations in northern regions.[12]

Historically First Nations have used whatever means available to rebuild and revitalize their communities. This includes their ongoing struggle to develop and maintain adequate information and communication technology (ICT) infrastructure, applications, training, and ongoing support and maintenance. Broadband infrastructures open up many new possibilities for them to deliver and access public services and economic development opportunities. These efforts are funded through mechanisms established by the federal government's Indian Act (1985)[13] and implemented by an urban-based, centralized agency called Aboriginal Affairs and Northern Development Canada (AANDC). Some commentators argue that these governance and funding structures are forever

[7] Dorothea Kleine, *Technologies of Choice? ICTs, Development, and the Capabilities Approach* (Cambridge, MA: The MIT Press, 2013).
[8] Susan Crawford, *Captive Audience: The Telecom Industry and Monopoly Power in the New Gilded Age* (New Haven, CT: Yale University Press, 2013).
[9] Krishna Jayakar, "Promoting University Broadband through Middle Mile Institutions: A Legislative Agenda," *Journal of Information Policy* 1 (2011): 102-124.
[10] See for example Adam Fiser and Andrew Clement, "A Historical Account of the Kuh-Ke-Nah Network: Broadband Deployment in a Remote Canadian Aboriginal Telecommunications Context," *in Connecting Canadians: Investigations in Community Informatics*, ed. Andrew Clement, Michael Gurstein, Marita Moll, and Leslie R. Shade (Edmonton, AB: Athabasca University Press, 2012), 255-282; Tim Whiteduck and Brian Beaton, "Building First Nation Owned and Managed Fibre Networks across Quebec," *Journal of Community Informatics* 10 (2014), accessed May 13, 2014, http://ci-journal.net/index.php/ciej/article/view/1107/1084.
[11] John Borrows, *Canada's Indigenous Constitution* (Toronto: University of Toronto Press, 2010).
[12] Pamela D. Palmater, "Stretched Beyond Human Limits: Death By Poverty in First Nations," *Canadian Review of Social Policy*, 65-66 (2011): 112-127.
[13] The text of the Indian Act can be found at http://laws-lois.justice.gc.ca/eng/acts/i-5/.

changing at the discretion of government agencies with little or no knowledge or experience in the environments in which they are applied.[14]

But at the same time, these communities are centers of local and regional innovation. Researchers have marshalled the concept of the First Mile to explain the decentralizing development paradigm undertaken by some First Nations.[15] These First Mile initiatives are often motivated by need. The market-based and centrally-driven solutions described above do not apply in communities located at the end of the road. Instead, faced with the problem of market failure for broadband services, some of these communities have exerted control over the development and management of their own infrastructures. They are proving that social and public services can be designed, deployed, and configured by user communities – provided that capacity and other supports are in place. However, they also face many internal and external challenges. The combination of a policy environment grounded in relations of colonialism and the extension of digital networks into these communities challenges their political and institutional autonomy. Centralized institutions, including government funders, are thus in a position to either encourage or prevent these alternatives.

In this article, we demonstrate the policies and practices that interact through First Mile broadband and service delivery to the First Nations of northern Ontario, Canada. The efforts of these communities and their partners demonstrate both the nature and use of a decentralized First Mile approach in a digital environment. They provide an example for other communities interested in engaging in innovative broadband service redesign and redevelopment.

BROADBAND DEVELOPMENT BY AND IN REMOTE AND RURAL REGIONS: FIRST NATIONS COMMUNITY INTERMEDIARY ORGANIZATIONS

Canada has a universal service requirement for telephone service but not for Internet service or broadband infrastructure. Government policy to support broadband in remote and rural First Nation communities is also underdeveloped and uncoordinated among many different departments and program areas.[16] Since 1996, a variety of funding initiatives, strategies, and projects have been implemented to support broadband infrastructure and increased use of ICT in First Nations communities. But these initiatives face tensions with market-oriented development models. Given their imperative to provide returns to shareholders, commercial telecommunication service providers are reluctant or slow to develop and manage infrastructure in many remote and rural regions of the country without significant government investment. Consequently it is challenging to build the

[14] Glenn S. Coulthard, "Subjects of Empire: Indigenous Peoples and the 'Politics of Recognition' in Canada," *Contemporary Political Theory* 6 (2007): 437-460

[15] Rob McMahon, Susan O'Donnell, Richard Smith, Brian Walmark, Brian Beaton and Jason Simmonds, "Digital Divides and the 'First Mile': Framing First Nations Broadband Development in Canada," *The International Indigenous Policy Journal* 2, no. 2 (2011): article 2.

[16] Rob McMahon, Susan O'Donnell, Richard Smith, Jason Woodman Simmonds, and Brian Walmark, "Putting the 'Last-Mile' First: Re-Framing Broadband Development in First Nations and Inuit Communities," white paper, Centre for Policy Research on Science and Technology at Simon Fraser University, Dec. 2010, accessed May 13, 2014, http://meeting.knet.ca/mp19/file.php/106/Putting-the-Last-Mile-First-Dec-1-2010.pdf.

partnerships necessary to develop infrastructure and provide equitable and affordable services in these communities. As a result, today many remote and rural First Nations communities remain without the infrastructure or resources to support essential broadband applications and services.

In recent years, these challenges have been compounded due to the effects of structural adjustment policies associated with neoliberal governance regimes around the world.[17] In the wake of austerity measures, a diverse array of third sector organizations has emerged to meet the need for public services formerly provided by government agencies.[18] These include non-governmental organizations, civil society organizations, not-for-profits, cooperatives, community economic development organizations, public sector non-profits, and a host of others. In this article, we highlight a specific type of third sector organization that mediates between rural and remote communities and public and private sector organizations typically situated in urban and metropolitan spaces.[19] Rather than distributing resources directly to aid recipients, these organizations act as mediators between local stakeholders and the external entities -- typically governments -- with a stake and interest in their well-being. Mobilizing capital, technical assistance, and other resources, these "community intermediaries" aim to empower local stakeholders to enhance their own conditions and development opportunities.[20]

In the context of technology development, these organizations utilize digital networks and ICT to support and deliver public services like health and education, as well as economic development opportunities.[21] Their work is differentiated into various organizational forms, including place-based Community Technology Centres and online Community Computing Networks (like free-nets and community development networks).[22] They include the "middle mile" institutions defined by Jayakar as "predominantly non-profit, local, community service institutions connected to the middle mile, which may be terminals for broadband traffic and/or act as demand aggregators serving the wider community." [23] We frame these middle-mile organizations as "community intermediaries" to foreground their deep connections to First Nations.

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[17] David Harvey, *A Brief History of Neoliberalism* (New York: Oxford University Press, 2005).
[18] See for example Kerri Gibson, Susan O'Donnell, and Vanda Rideout, "The Project-Funding Regime: Complications for Community Organizations and Their Staff," *Canadian Public Administration* 50 (2007): 411-436; Susan MacDonald, Graham Longford, and Andrew Clement, "Community Networking Experiences with Government Funding Programs: Service Delivery Model or Sustainable Social Innovation?" in *Connecting Canadians: Investigations in Community Informatics*, ed. Andrew Clement, Michael Gurstein, Marita Moll, and Leslie R. Shade (Edmonton, AB: Athabasca University Press, 2012), 393-417; Jack Quarter and Laurie Mook, "An Interactive View of the Social Economy," *Canadian Journal of Nonprofit and Social Economy Research (ANSERJ)* 1 (2010): 8-22.
[19] Thomas F. Carroll, *Intermediary NGOs: The Supporting Link in Grassroots Development* (Hartford, CT: Kumarian Press, 1992).
[20] Quarter and Mook.
[21] Vanda N. Rideout and Andrew J. Reddick, "Sustaining Community Access to Technology: Who Should Pay and Why!" *Journal of Community Informatics* 1 (2005): 45-62; Vanda N. Rideout, Andrew J. Reddick, Susan O'Donnell, William McIver, Sandy Kitchen, and Mary Milliken, "Community Organizations in the Information Age: A Study of Community Intermediaries in Canada," white paper, Community Intermediaries Research Project (2007), accessed May 13, 2014, http://ci-journal.net/index.php/ciej/article/view/414/314.
[22] Lisa J. Servon, *Bridging the Digital Divide: Technology, Community, and Public Policy* (Malden, MA: Blackwell Publishing, 2002).
[23] Jayakar, 104.

In Canada, First Nations across the country have established community intermediary organizations to provide technology support services to their constituent populations. This work was supported by a federal policy framework designed to drive connectivity in rural and remote communities in the late 1990s and early 2000s. The "Connecting Canadians" policy framework, and associated programs like First Nations SchoolNet and the Community Access Program, contracted a national network of First Nations organizations to administer programs on a regional basis. When Industry Canada decentralized First Nations SchoolNet in 2002, these six (later seven) First Nations Regional Management Organizations became involved in this work. Through these developments, aside from the Atlantic provinces (collectively administered by Atlantic Canada's First Nation Help Desk), by 2010 every province in Canada had its own First Nation community intermediary.

These organizations operate complex digital networks and applications while enabling their constituents to assert self-determined development goals in a complicated and dynamic multi-stakeholder environment. One of their functions is to bridge the gap between remote First Nations and federal and provincial government agencies by contributing to policy development and helping central government agencies maintain communications with people living in remote communities. They also work with local communities and private sector telecommunications companies to set up and operate industry standard broadband infrastructure, and deliver a host of online applications. These community intermediary organizations are First Nation-owned and -controlled social enterprises that compete for government contracts to provide services to their member communities. They manage and support public and community services, including online education, training in digital literacy, and e-health.

This work is the result of close consultation and engagement with their members. First Nations constituents direct their work and give them a mandate, which enables these institutions to deliver various services efficiently, effectively, and in line with the goals and aspirations of First Nations.[24] While they share many goals, distinctions among regions has led to a diversity of organizational structures and strategies among First Nation community intermediaries. Partnerships with government agencies and private sector organizations are rooted in regional contexts, as well as in complex patterns of state/Aboriginal relations.[25] However, these organizations all reflect a strong focus on consultation and engagement with their membership of geographically dispersed, politically autonomous First Nations.[26] This makes them unique when compared to other telecommunications and broadband providers. For example, Fiser concluded that although private sector incumbent

[24] Susan O'Donnell, Sonia Perley, Brian Walmark, Kevin Burton, Brian Beaton, and Andrew Sark, "Community Based Broadband Organizations and Video Communications for Remote and Rural First Nations in Canada," in *Communities in Action: Papers in Community Informatics,* ed. Larry Stillman, Graeme Johanson, and Rebecca French (Newcastle upon Tyne, UK: Cambridge Scholars Publishing, 2009), 107-119.

[25] Rob McMahon, "The Institutional Development of Indigenous Broadband Infrastructure in Canada and the United States: Two Paths to 'Digital Self-Determination'," *Canadian Journal of Communication* 35 (2011): 115-140.

[26] For case studies that illustrate some of the distinctions among Indigenous community networks, see Catherine Middleton and Barbara Crow, "Building Wi-Fi Networks for Communities: Three Canadian Cases," *Canadian Journal of Communication* 33 (2008): 419-441; Javier Mignone and Heather Henley, "Impact of Information and Communication Technology on Social Capital in Aboriginal Communities in Canada," *Journal of Information, Information Technology, and Organizations* 4 (2009): 127-145.

telecommunications companies provided low-speed digital infrastructure in 70% of Aboriginal communities in Canada (as of 2009), they remained divorced from the geographic and cultural contexts of communities, lacked flexibility and accountability in their relations with local users, and did not reflect a deep understanding of the history and development goals of Indigenous communities.[27] In comparison, First Nations community intermediaries receive organizational mandates directly from their members. Their governance structures, and the various support programs they administer, are generated by and accountable to the local communities they represent.

The work of First Nation community intermediaries is supported nationally through the Assembly of First Nations (AFN). A national political organization composed of the elected Chiefs of all formally incorporated First Nations, the AFN meets several times a year and provides a central point of contact for its members. Over the years, Chiefs-in-Assembly have passed several resolutions that defined digital networks and ICTs as tools to support First Nations self-determination and suggested that community intermediaries are a key means to pursue that strategic goal. To this end, the AFN advocates for federal government funding to increase the resources and administrative responsibilities of the intermediaries. The AFN also formed an ICT Working Group, a national network of technical experts (including staff from community intermediary organizations), which is supported through funding from AANDC.

The activities of the AFN and the First Nation community intermediaries are collectively guided by a conceptual framework called the e-Community ICT model. This strategic planning initiative aims to establish a skilled public service in every First Nation.[28] It fosters the creation, utilization, and sustainable operation of First Nation networks. The e-Community model was first introduced by Keewaytinook Okimakanak's KNET (KO-KNET) services in 2005, adopted by the AFN in 2008, and published in 2009.[29] Since their emergence through the First Nations SchoolNet program, community intermediaries have worked with their member First Nations to establish this model in local contexts, and received a clear mandate from the Chiefs to do so in 2011.[30]

Community intermediaries also face significant challenges. Even as their roles and responsibilities have grown over time, they face an operating environment constrained by structural changes to government policy frameworks. Despite evidence of their benefits in terms of service provision, capacity building, and encouraging broadband adoption among marginalized populations, Jayakar describes several challenges that middle-mile organizations in the U.S. face that also apply in Canada. These include the

[27] Adam Fiser, "A Map of Broadband Deployment in Canada's Indigenous and Northern Communities: Access, Management Models, and Digital Divides (circa 2009)," *Communication, Politics & Culture* 43 (2010): 7-47.
[28] Judy Whiteduck, "Building the First Nation e-Community," in *Aboriginal Policy Research: Learning, Technology and Traditions*, ed. Jerry P. White, Julie Peters, Dan Beavon, and Peter Dinsdale (Toronto: Thompson Educational Publishing, 2010), 95-103.
[29] Penny Carpenter, "The Kuhkenah Network (K-Net)," in *Aboriginal Policy Research: Learning, Technology and Traditions*, ed. Jerry P. White, Julie Peters, Dan Beavon, and Peter Dinsdale (Toronto: Thompson Educational Publishing, 2010), 119-127.
[30] Gilbert Whiteduck, Anita Tenasco, Susan O'Donnell, Tim Whiteduck, and Emily Lockhart, "Broadband-Enabled Community Services in Kitigan Zibi Anishinabeg First Nation: Developing an e-Community Approach," paper presented at the International Rural Network Forum, Whyalla and Upper Spencer Gulf, Australia, Sept. 24-28, 2012.

lack of predictable, sufficient, and long-term financial support, as well as legal and policy challenges to support their work. In Canada, growing demand among First Nations constituents for services, declining funding and institutional support, and an increased focus on reporting and accountability from government all threaten to undermine their sustainability.[31]

At the same time, people working in government agencies must contend with challenges arising from budgetary cuts and other reforms associated with austerity measures. A focus on "evidence-based" quantitative research for policy development is also challenging in a context where available data is partial, ever-changing, and difficult to access.[32] Specific challenges include financial pressures, political tensions, and challenges to organizational viability.[33] Government funders are putting in place additional accountability and reporting requirements, while withdrawing financial and other resources. Partnerships with private sector or other organizations strain limited human and technical resources.[34] In short, First Nations, community intermediaries, and governments are all grappling with the impact of these converging trends.

KO-KNET: INNOVATIVE BROADBAND DEVELOPMENT IN NORTHERN ONTARIO

The First Nation community intermediary in the province of Ontario presents a grounded example of the challenges and successes associated with this work. KO-KNET provides broadband services to remote and rural First Nations, in particular in the sparsely-populated northern regions of the province.[35] The 25,000 residents of the Sioux Lookout region live in 25 communities, most with populations of 300 to 500, and the five largest communities with over 1,000 inhabitants. These First Nations are connected through a winter road network during a short period each winter, but rely on flights for the rest of the year. Their geographic isolation results in challenging participatory opportunities concerning decision-making about the policies and regulations that guide various developments.[36] At the same time these remote First Nations are innovating to secure community control over governance, education, health and many other services.

In 1991, the leadership of seven Oji-Cree, Cree, and Ojibway First Nations located in this region formed the Keewaytinook Okimakanak[37] tribal council to ensure more First Nation control over community services, operations, and activities. Today the six KO First Nations are Fort Severn, North

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[31] McMahon, O'Donnell, Smith, Simmonds, and Walmark.
[32] Adam Fiser, "First Nations IT Labour Force and Human Capacity: What Are the Socio-Economic Indicators?" discussion paper, Assembly of First Nations, First Nations E-Community, Feb. 17, 2012.
[33] Middleton and Crow; MacDonald, Longford, and Clement.
[34] Ibid.
[35] Brian Beaton, Jesse Fiddler, and John Rowlandson, "Living Smart in Two Worlds: Maintaining and Protecting First Nation Culture for Future Generations," in *Seeking Convergence in Policy and Practice: Communications in the Public Interest*, vol. 2, ed. Martia Moll and Leslie R. Shade (Ottawa: Canadian Centre for Policy Alternatives, 2004), 283-297. See also Carpenter.
[36] Rob McMahon, Heather Hudson and Lyle Fabian, "Indigenous Regulatory Advocacy in Canada's Far North: Mobilizing the First Mile Connectivity Consortium," *Journal of Information Policy* 4 (2014): 228-249.
[37] Keewaytinook Okimakanak (KO) means "Northern Chiefs" in the Oji-Cree language.

Spirit Lake, Keewaywin, Deer Lake, Poplar Hill, and McDowell Lake. In 1994, this group developed a "Stay in School" project to establish a computer bulletin board system (BBS) so that parents could maintain communications with their children as they attended school in faraway urban centers. At the time, telephone service only existed in three of the six KO First Nations. The new network was called the Kuhkenah Network,[38] shortened to KNET. Over 18 years, the KO First Nations developed KO-KNET from a basic BBS to a regional community intermediary organization with points of presence in 94 First Nations across Ontario, and connections with communities and regions across Canada.

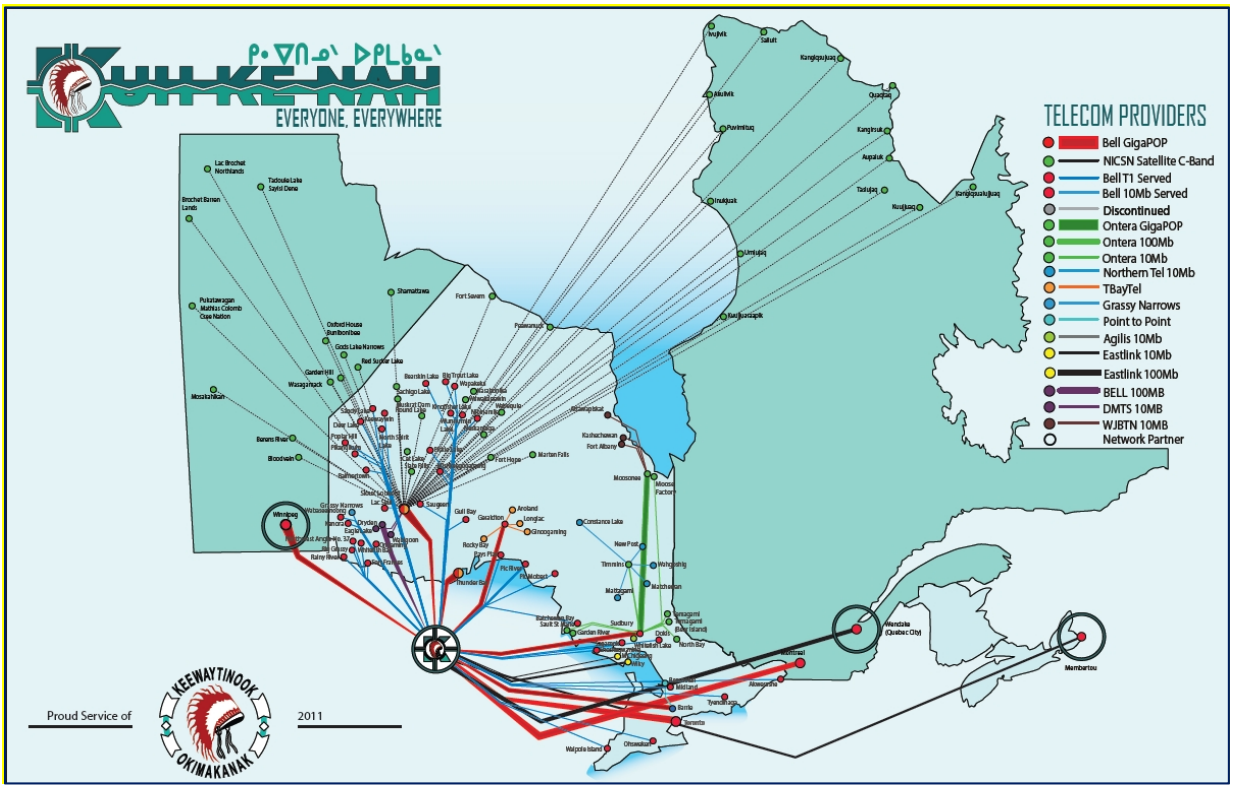

Figure 1: KO-KNET's Network Map (circa 2011)

In the late 1990s, as a regional management organization for Industry Canada's First Nations SchoolNet, KO-KNET led several studies that recommended broadband development across the region. In 1999, Industry Canada announced the national Smart Communities Demonstration program, and after an extensive competition, twelve demonstration projects received funding: one from each province; one from the far north; and one Aboriginal project. KO-KNET became the Smart Aboriginal Demonstration project. It used the four-year, CAD $10 million in funding to invest in community and regional broadband infrastructure and applications. These investments included

[38] Kuhkenah means "everyone" or "everywhere" in the Oji-Cree language.

community coaxial cable networks, regional public service broadband applications, a videoconferencing network, the Northern Indigenous Community Satellite Network (NICSN), and several other online services. When the project wrapped up in 2005, most remote First Nations in the Sioux Lookout region either operated or were developing locally-owned community broadband networks, with KO-KNET's support. Ten years later, these developments are still growing, as seen in the image above illustrating KO-KNET's network (circa 2011).

As a non-profit social enterprise, KO-KNET contracts with many organizations, including First Nations, governments, and private companies. Its budget and strategic plan are developed in collaboration with the leadership of the KO First Nations, and most of the organization's 16-person staff are First Nation people from the region. Operations are funded through business contracts for network, training, and other services. Surplus revenues are dedicated to capacity building and network upgrades among member First Nations.

Training is a primary focus of KO-KNET's services. Specific projects include youth summer technology camps and professional training in digital literacies for teachers and school administrators, community water plant operators,[39] tele-health technicians, and other local professionals. KO-KNET also works with institutions like Confederation College and Brock University to develop and deliver distance education over videoconferencing. These initiatives translate into local skilled employment in First Nations, through jobs like cable plant technicians and videoconferencing coordinators. KO-KNET supports this use of ICTs through toll-free telephone service, online support, and a fully-staffed IT helpdesk. The organization was also involved in the Community Access Program, which established, staffed, and maintained public access points in remote First Nations across Ontario.

KO-KNET also builds broadband infrastructure in partnership with communities and strategic partners. From 1999 to 2001, it led upgrades to digital radio, satellite, and data services. It also supported the development of a wide-area computer network to connect Band office programs, health services, and education services in each KO member community. Construction of First Nation cable plants connecting local buildings began in 2001 and there are now 24 of these First Nation-owned cable networks working with KO-KNET. In 2005, KO-KNET and two Indigenous partners in Quebec and Manitoba launched the Northern Indigenous Community Satellite Network (NICSN).[40] This project has demonstrated that with the proper funding supports, a regional satellite network can be owned, managed, operated, and maintained as a non-profit cooperative. In 2007, the NICSN group secured bandwidth until 2019, with support from the federal government (Infrastructure Canada and Industry Canada) and in-kind contributions from their satellite provider, Telesat Canada. KO-KNET is now working with several formerly satellite-served First Nations to transition to fiber infrastructure through a Bell Aliant fiber build involving 24 remote First Nations. One of the most ambitious

[39] Michael Gurstein, Brian Beaton, and Kevin Sherlock, "A Community Informatics Model for e-Services in First Nations Communities: The K-Net Approach to Water Treatment in Northern Ontario," *Journal of Community Informatics* 5, no. 2 (2009), accessed May 13, 2104, http://ci-journal.net/index.php/ciej/article/view/383/454.
[40] Rob McMahon, "Digital Self-Determination: Aboriginal Peoples and the Network Society in Canada," doctoral dissertation, Simon Fraser University (2013), accessed May 13, 2014, http://summit.sfu.ca/system/files/iritems1/13532/etd7913_RMcMahon.pdf.

infrastructure projects launched by KO-KNET and its partner First Nations is Keewaytinook Mobile, or K-Mobile. This community-owned cellular and data services network incorporates a billing system that allows K-Mobile customers to manage their own service plans.[41]

As well as infrastructure builds, KO-KNET also develops and supports broadband-enabled First Nation community services. Two of the most notable examples are the Keewaytinook Internet High School (KiHS) and KO Telemedicine (KOTM). KOTM, the only tele-health network managed and operated by Aboriginal people in Canada, provides services in First Nations across northwestern Ontario.[42] KiHS was the first accredited First Nations digital school in Canada, and began delivering online courses in 2000. It has since expanded into a network of more than a dozen high school classrooms located in remote First Nations in Ontario's far north.[43] KO-KNET gains revenues from government departments that pay to use the network for services like KOTM and KiHS.

Finally, KO-KNET is involved in advocacy and policy work. To this end it negotiates with federal, provincial, regional, local, and First Nation governments. This work includes KO-KNET's active participation in the Assembly of First Nations national IT working group, as well as representation on national bodies such as the National Broadband Task Force and the AFN. Through this work KO-KNET led the development of the e-Community model of community-owned and managed local broadband infrastructure described earlier. Most recently, the organization is implementing a KO e-Community learning and information exchange using platforms like Drupal and Facebook to engage community members and raise awareness of technology developments and opportunities. Finally, KO-KNET engages in research through Keewaytinook Okimakanak's Research Institute (KORI). Graduate students and researchers work closely with KO and KO-KNET staff. Respectful and inclusive strategies ensure local ownership and control of First Nations stories and data.

The work done by community aggregator organizations like KO-KNET is driven by the on-the-ground efforts of the people living in member First Nations. Along with providing the mandate and guidance for their activities, community members manage local operations and delivery of infrastructure and services developed by organizations like KO-KNET. In the next section we focus on one of KO-KNET's member communities, the Washaho Cree Nation at Fort Severn, to illustrate this essential work.

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[41] Susan O'Donnell, George Kakekaspan, Brian Beaton, Brian Walmark, Raymond Mason, and Michael Mak, "A New Remote Community-Owned Wireless Communication Service: Fort Severn First Nation Builds Their Local Cellular System with Keewaytinook Mobile," *Canadian Journal of Communication* 36 (2011): 663-673.

[42] Penny Carpenter and Tina Kakepetum-Schultz, "Above and Beyond: Embedding Community Values and Beliefs into an Evolving First Nations IT Health System," paper presented at the E-Health COACH Conference, Vancouver, BC, May 29-31, 2010; Donna Williams, "Telehealth/Telemedicine Services in Remote First Nations in Northern Ontario," in *Aboriginal Policy Research: Learning, Technology and Traditions*, ed. Jerry P. White, Julie Peters, Dan Beavon, and Peter Dinsdale (Toronto: Thompson Educational Publishing, 2010), 159-168.

[43] Darrin Potter, "Keewaytinook Internet High School Review (2003-2008)," in *Aboriginal Policy Research: Learning, Technology and Traditions*, ed. Jerry P. White, Julie Peters, Dan Beavon, and Peter Dinsdale (Toronto: Thompson Educational Publishing, 2010), 147-155; Brian Walmark, "Digital Education in Remote Aboriginal Communities," in *Aboriginal Policy Research: Learning, Technology and Traditions*, ed. Jerry P. White, Julie Peters, Dan Beavon, and Peter Dinsdale (Toronto: Thompson Educational Publishing, 2010), 140-146.

BROADBAND DEVELOPMENT IN A REMOTE COMMUNITY: THE CASE OF FORT SEVERN WASHAHO CREE NATION

The northernmost Arctic community in Ontario, Fort Severn is home to about 400 people, with another 250 community members who live elsewhere most of the time. Most residents speak Cree, and school-educated people speak English. Every two years, Fort Severn community members elect a Chief and Band Council, and Elders also have a prominent leadership role in the community.

The people of Fort Severn have a long history of shaping communications technologies to meet their needs.[44] Cree people have been living in the Hudson Bay area for thousands of years, communicating and sharing their stories and information. The land and the waterways continue to support people who practice their traditional hunting, trapping, fishing, and harvesting skills in this fragile but harsh environment. Much community life in Fort Severn happens outdoors, and for many residents life is seasonal and grounded in the environment, lands, and resources. Social and community activities involve hunting and trapping on the land, or fishing on the water and ice. Almost every household depends on the land and its resources for food, and the region is rich in wildlife, fish, and berries. For about two months each winter, Fort Severn and other remote communities in the region are connected by winter roads and it becomes possible to drive to the closest regional center, Sioux Lookout, in about 24 hours. After the winter roads have melted, Fort Severn is very isolated and expensive to visit, with flights from a major city like to Toronto costing about CAD $2,000.

These conditions mean that strong communication links and infrastructure are very important to the residents of Fort Severn. Community members have a history of tailoring their use of new technologies to suit their needs – whether canoes and snowshoes or Ski-Doos and videoconferencing. Even before digital infrastructure and communications arrived in their community, people developed and implemented a radio station in the 1980s and a cable TV service in the early 1990s (local telephone services were provided by Bell Aliant over C-Band satellite service).[45]

When new ICT tools became available in Fort Severn, residents quickly embraced and accepted them as yet another way to develop their community. Locals recognized the potential of these tools for business opportunities, and to access school and health care services. Since those early days, they have developed their own digital content, programs, services, and infrastructure. To undertake these projects, community members with very little background in telecommunications or information technology took advantage of training programs and support systems provided by KO-KNET in both offline and online forums.

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[44] For more information on ICTs in Fort Severn, see Fort Severn First Nation, "Technology Showcase," accessed May 13, 2014, http://fortsevern.firstnation.ca/tech_showcase. For a summary, see Kerri Gibson, Matthew Kakekaspan, George Kakekaspan, Susan O'Donnell, Brian Walmark, Brian Beaton, and the People of Fort Severn First Nation, "A History of Communication by Fort Severn First Nation Community Members: From Hand Deliveries to Virtual Pokes," paper presented at the iConference, Toronto (2012), accessed May 13, 2014, http://meeting.knet.ca/mp19/file.php/16/Publications/2012-Fort_Severn_History_of_Communication.pdf.

[45] Fort Severn First Nation.

This work began in early 1999, when Fort Severn's tribal council, KO, commissioned a study of the telecommunications needs of its member communities.[46] At that time data communications were severely limited in Fort Severn, and the primary local bottleneck for dial-in Internet was the MSAT outbound connection, installed as part of the First Nations SchoolNet program. During the consultation process associated with this study, Fort Severn community members identified several key priorities for network services: building a network to connect all of the communities, making the Internet more accessible, and videoconferencing. Community priorities included health and education. When Fort Severn hosted a workshop to discuss planned satellite upgrades, the community identified governance, education, and health as the three main areas for development.

In May 2000, Fort Severn received funding through the Kuhkenah SMART First Nations Demonstration project. As described earlier, this initiative supported infrastructure and application development strategies in KO-KNET's member communities. As a partner in this project, Fort Severn worked with KO-KNET (with additional funding from Industry Canada's FedNor) to install C-Band earth stations in Sioux Lookout and Fort Severn. As part of this early community satellite network, Fort Severn shared bandwidth with two other First Nations (Anaheim Lake and Slate Falls) to access 128 Kbps Internet and 512 Kbps on-demand video. The following summer, Fort Severn worked with KO-KNET to use the existing community TV cable network to provide Internet services to local households.

The SMART project opened up new possibilities for Fort Severn residents, who could now access more services and information online. In early 2002, connectivity was further upgraded to support medical-quality videoconferencing and X-ray transfer.[47] The community set up an e-Centre for residents without home Internet access, as well as a KiHS classroom and KOTM tele-medicine service. The Band created and filled three local IT positions, including a multimedia technician who looked after the community website, among other duties. Today, Fort Severn also operates a community-owned and managed cell service through the Keewaytinook Mobile service described earlier.

These developments all utilized the wide-area network operated by KO-KNET – a resource available to Fort Severn when it joined the satellite cooperative that became the NICSN satellite network described earlier. Fort Severn leadership continues to work closely with KO-KNET to effectively manage the content, traffic, and services on their local network.[48] Technicians use online tools to support the effective use of Fort Severn's IP network, such as for coaxial cable management, videoconferencing booking, and local bandwidth management. The local technician also provides

[46] Hans Jansen and George Bentley, "Ontario's Far North Study: Broadband Best Practices and Benefits in Fort Severn First Nation," white paper, Connect Ontario and Industry Canada (2004). See also Keewaytinook Okimakanak, "From Potential to Practice: Telecommunications & Development in the Nishnawbe-Aski Nation," white paper, Industry Canada/FedNor, Mar. 31, 2001, accessed May 13, 2014, http://knet.ca/NAN-wide.pdf.
[47] George Kakekaspan, "Essential Telecommunication Services: Building a Healthy and Smart Community Using Information Communication Technologies," paper presented at the SMART City Summit, Ottawa, Apr. 2002.
[48] Matthew Kakekaspan, Susan O'Donnell, Brian Beaton, Brian Walmark, and Kerri Gibson, "The First Mile Approach to Community Services in Fort Severn First Nation," *Journal of Community Informatics* 10, no. 2 (2014), accessed May 13, 2014, http://ci-journal.net/index.php/ciej/article/view/998/1091.

consistent maintenance and upgrades for equipment (computers, routers, satellite equipment, modems, videoconferencing units, phones, and so on) and cabling throughout the community.

As Fort Severn's broadband infrastructure and services developed, the community required more ICT resources and capacity. For example, the Washaho School lacks IT equipment, resources, and support. The Band would like to complete land-use planning studies using GPS and mapping technology but needs more staff, technical, and related resources to do so. Now that the SMART Communities program funding has ended, the First Nation can only support one IT position – the e-Centre manager, who also provides IT support to local organizations and community members who subscribe to ICT services like community Internet, cable TV, and Keewaytinook Mobile.

Professional development and training for staff working on service delivery is another challenge. Many service areas lack budgets to train new staff. Fort Severn First Nation, like most First Nations across the country, is constantly negotiating with governments for sufficient resources. Having access to adequate funding is always a challenge and First Nations like Fort Severn do not feel fully in control of the services that rely on that funding. This challenge is exacerbated by low awareness of the structure and operations of ICT infrastructure. The community's leadership clearly recognizes the community's ownership and control of many aspects of technical infrastructure – such as their C-Band satellite equipment. But people delivering the services are often unaware of who owns and manages satellite and broadband infrastructure, and had mixed views about community ownership of broadband.[49]

The First Mile concept provides one way for residents of communities like Fort Severn to articulate how they might address these challenges. It presents a discursive shift from the arguably passive position associated with being a customer relying on external organizations, to an active position where the local community builds, manages, and delivers local infrastructure and services. From this community informatics perspective, control of infrastructure provides many opportunities for service redesign and redevelopment to respond to local conditions and requirements.[50] This development path is shaped by several conditions: the perception among community members of the opportunity for autonomous development, the availability of financial resources and community intermediary organizations to support such development, the lack of interest or extension of external networks and service delivery capacity into local environments, and a recognition of community needs. The work undertaken by Fort Severn and community intermediary organizations like KO-KNET demonstrates how broadband infrastructures and services can act as a platform for e-Community services.

We suggest that this reflects a true community informatics, where the user community defines the needs and the design, development and deployment parameters of ICT-enabled services. The First Mile approach uses community processes as the building blocks and means for social and economic sustainability, and it can provide a model for similar developments elsewhere.

[49] Kakekaspan, O'Donnell, Beaton, Walmark, and Gibson.
[50] Gurstein, *What is Community Informatics (and Why Does It Matter?).*

CONCLUSION: A TWO-STEP FIRST MILE MODEL OF COMMUNITY INNOVATION WITH BROADBAND

The threads between the local and regional First Mile developments described in this article come together through a two-step model of community innovation.[51] The first step is when the community recognizes that it has the efficacy to respond to its local circumstances. Control over broadband networks and services provides a means for marginalized communities to turn from the dependency and passivity often assumed in relations of "last-mile" service provision, to instead focus on building the internal will and capacities to provide services themselves. In Canada, this reflects a perspective complementary to the important work of Indigenous scholars who advocate for "practical decolonization"[52] or "Indigenous resurgence"[53] as the means to rebuild Indigenous nations. Both approaches emphasize the strength and agency of people living in communities. In the context of digital ICTs, they provide a means to counteract the centralizing and market-based logics of many broadband development initiatives.

At the same time, if restricted to autonomous local initiatives, this work threatens to be overcome by powerful central institutions. The second step of the innovation process involves partnering with community intermediary organizations. Networks among local First Mile initiatives provide economies of scale and other shared resources that can shape infrastructures and services that are appropriate to local needs and circumstances. Intermediary organizations can work with their community constituents to provide technical and service expertise to support local capacity. This involves a process of iterative design that engages technical experts and community advisors. As shown in the cases of KO-KNET and Fort Severn First Nation, it includes experiments and pilot projects, testing and evaluation, and the eventual emergence of locally-managed and -controlled services.

It is true that certain unique circumstances led the First Nations in Northern Ontario to undertake this work. These include their identities as self-determining Indigenous nations situated inside the boundaries of a nation-state with very different cultural, political, social, and economic contexts. Other conditions include their close regional and local ties, their isolated geographic location, and the lack of infrastructures, services, and economic development opportunities associated with isolation. The strong sense of autonomy among these communities also derives in part from the connections of First Nations to their territories, and their unique political situation and jurisdictional powers *vis-à-vis* the Canadian state. Had communities in this region not undertaken their own development initiatives, the deployment of broadband infrastructure and services might have introduced a dependency on service

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[51] Michael Gurstein, "Community Innovation and Community Informatics," *Journal of Community Informatics* 9, no. 3 (2013), accessed May 13, 2014, http://ci-journal.net/index.php/ciej/article/view/1038/1022. See also Michael Gurstein, "Community Informatics and Community Innovation: Building National Innovation Capability from the Bottom Up," working paper, no date, accessed May 13, 2014, http://www.cmis.brighton.ac.uk/research/seake/cna/conference/proceedings/docs/Mike%20Gurstein.pdf.

[52] Taiaiake Alfred, *Wasáse: Indigenous Pathways of Action and Freedom* (Toronto: University of Toronto Press, 2009).

[53] Leanne Simpson, *Dancing on Our Turtle's Back: Stories of Nishnaabeg Re-Creation, Resurgence and a New Emergence* (Winnipeg, MB: Arbeiter Ring Publishing, 2011).

providers from outside the region. Instead, these communities managed to decentralize control of these key resources.

Our discussion may have highlighted the unique developments among the First Nations of northwestern Ontario, but this specificity does not preclude the application of the First Mile concept and approach in other cases. As discussed by Kleine, Crawford, and Jayakar, there are many instances of communities of interest who are recognizing how control of ICTs presents opportunities for development and public service provision. This point is clearly demonstrated in a recent issue of the *Journal of Community Informatics*, which illustrates a number of international examples of First Mile initiatives.[54] There is little reason why other communities could not develop similar projects that emerge from their own situated contexts.

First Mile projects may face competition and resistance from parties threatened by an understanding that developments at the periphery are not only possible, but potentially profitable. Despite these challenges, the initiatives that we have presented in this article can be a source of inspiration and direction for others involved in this work. The experiences of communities "at the end of the road" offer many benefits for people around the world for whom the promise and opportunity of ICTs have not yet been realized.

[54] See *Journal of Community Informatics* 10, no. 2 (2014), accessed May 12, 2014, http://ci-journal.net/index.php/ciej/issue/current. Note that this web address denotes the "current" issue as of the date accessed.

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